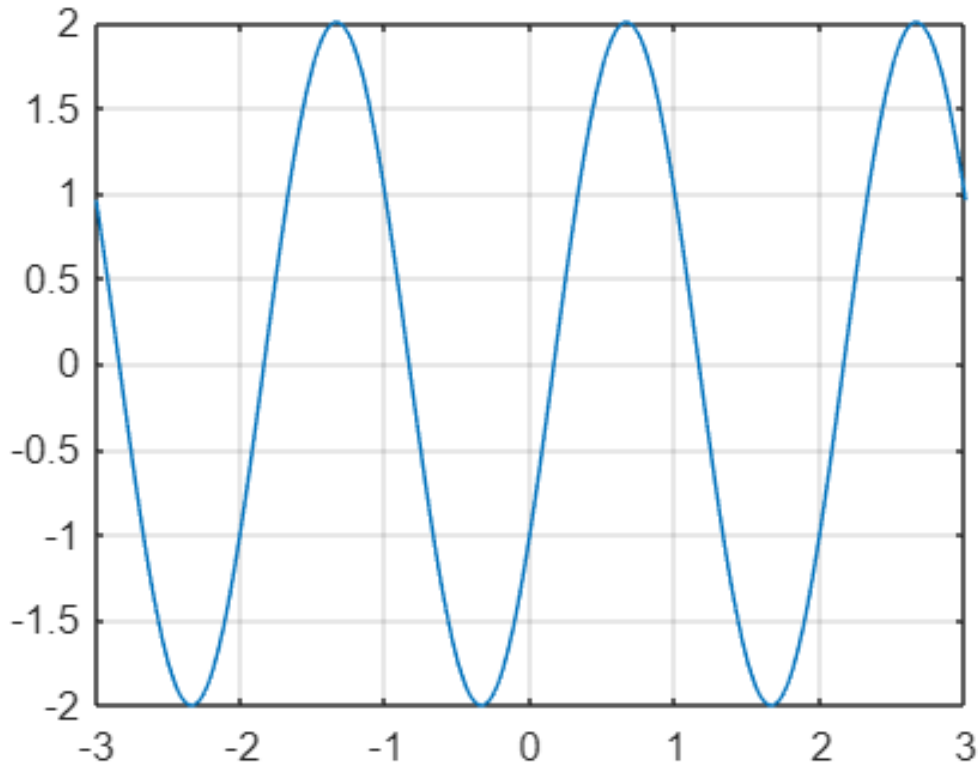


```

%% Ex. 1 a)
clear variables
T=2;
t=-3:0.01:3;
w=2*pi/T;
x=2*sin(t*w-0.5);
plot(t,x);grid
yticks(-2:0.5:2)
axis([-3 3 -2 2])

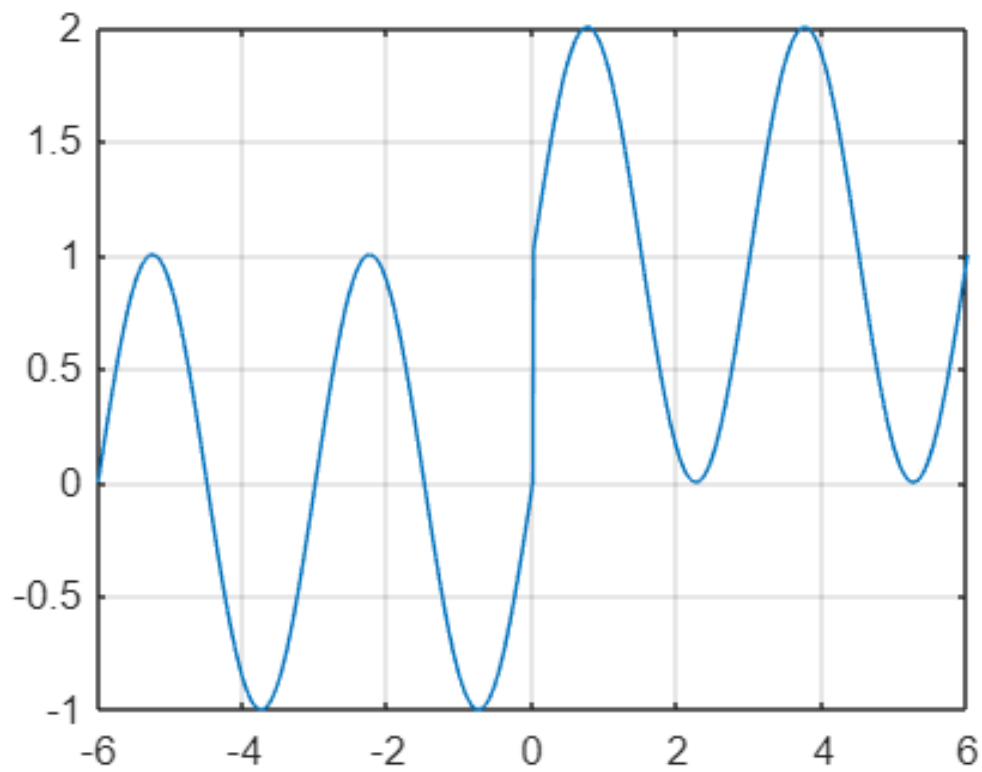
```



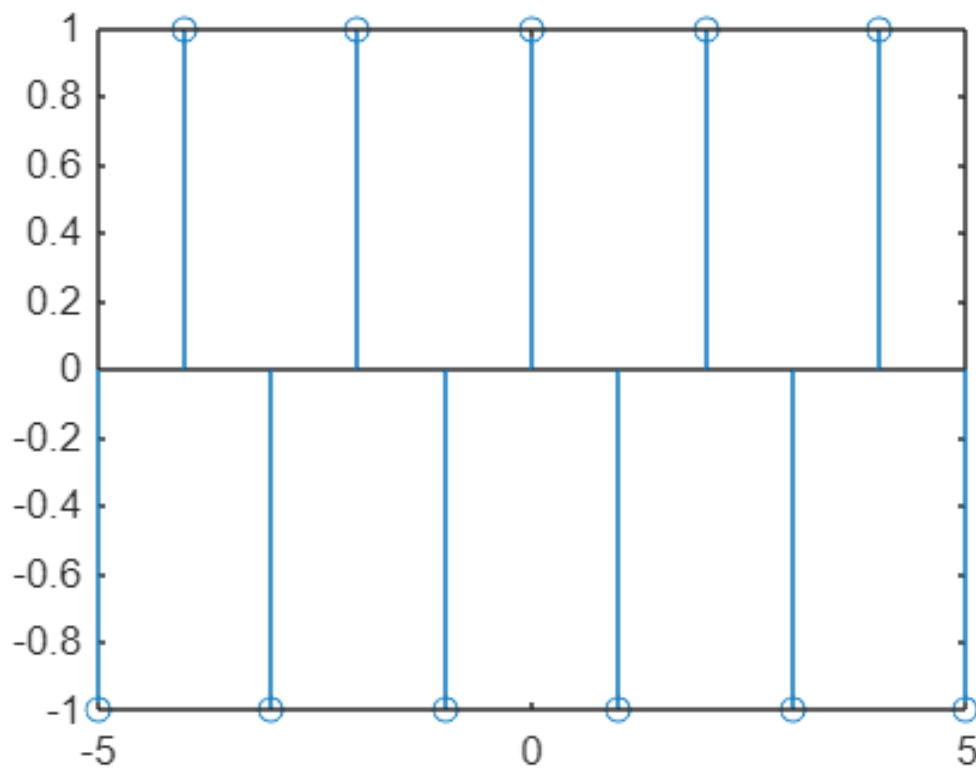
```

%b)
clear variables
T=3;
t=-6:0.01:6;
w=2*pi/T;
x=@(t) sin(t*w).*(t<=0)+(1+sin(t*w)).*(t>0);
plot(t,x(t));grid
axis([-6 6 -1 2])

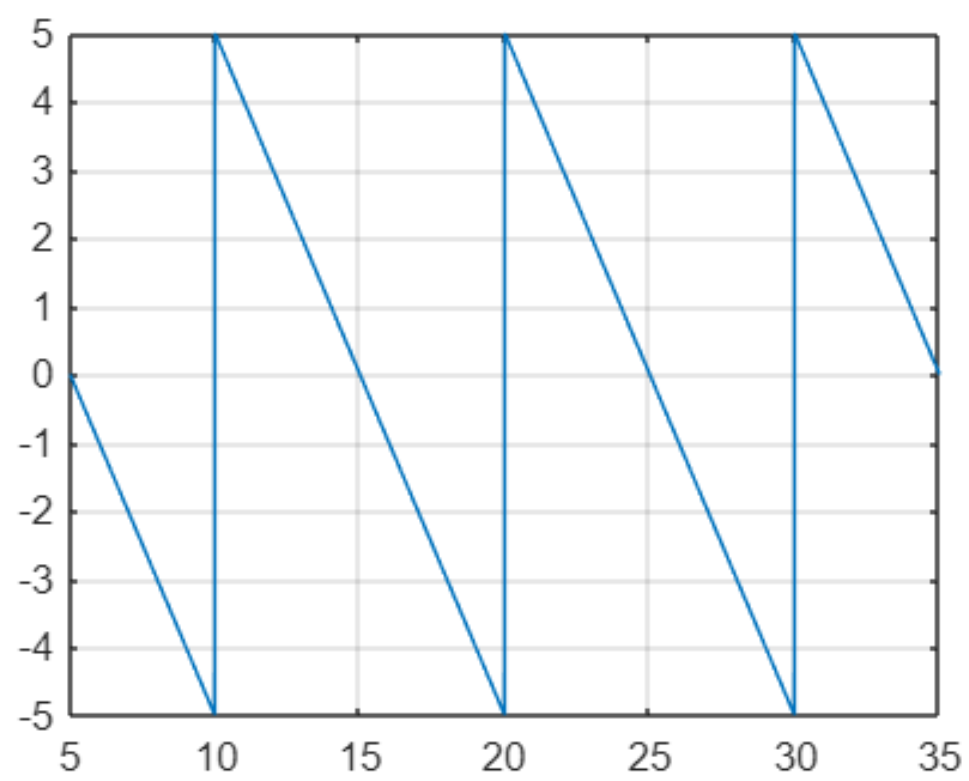
```



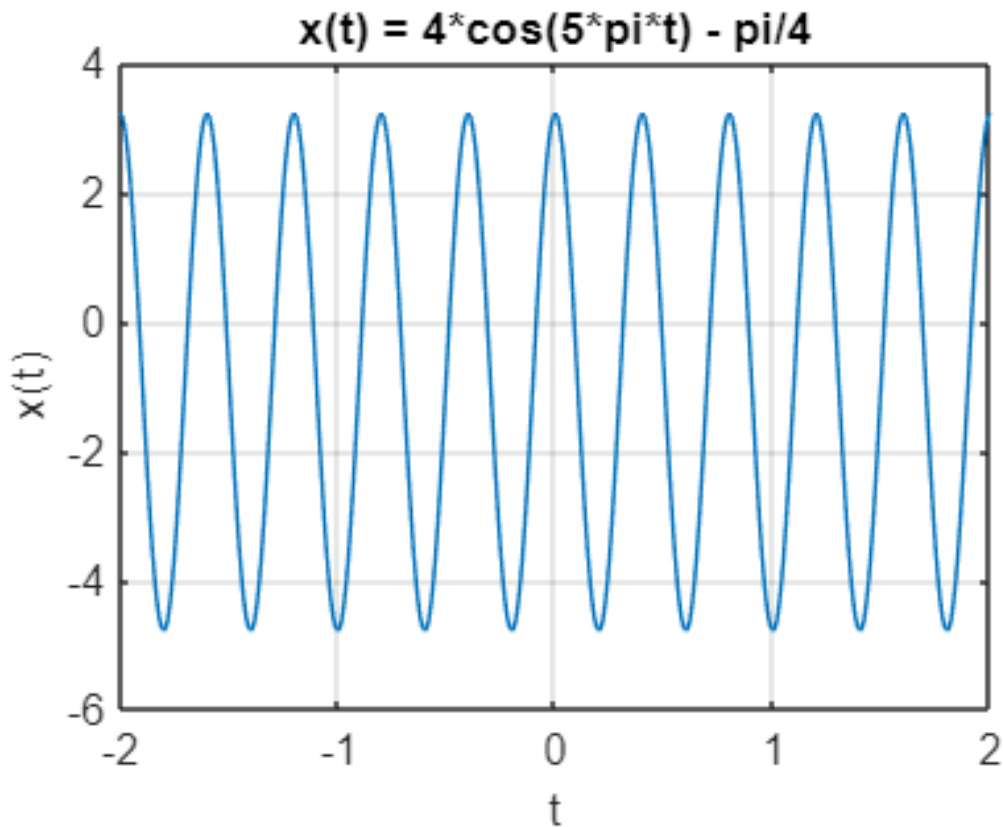
```
%c)
clear variables
N=5;
T=2;
n=-5:5;
w=2*pi/T;
xr=cos(w*n);
stem(n,xr);
yticks(-1:0.2:1)
axis([-5 5 -1 1])
```



```
%d)
clear variables;
T = 10;
w=2*pi/T;
t = 5:0.01:35;
x =(-5)*sawtooth(w*t);
plot(t,x);grid
yticks(-5:1:5)
axis([5 35 -5 5])
grid on
```

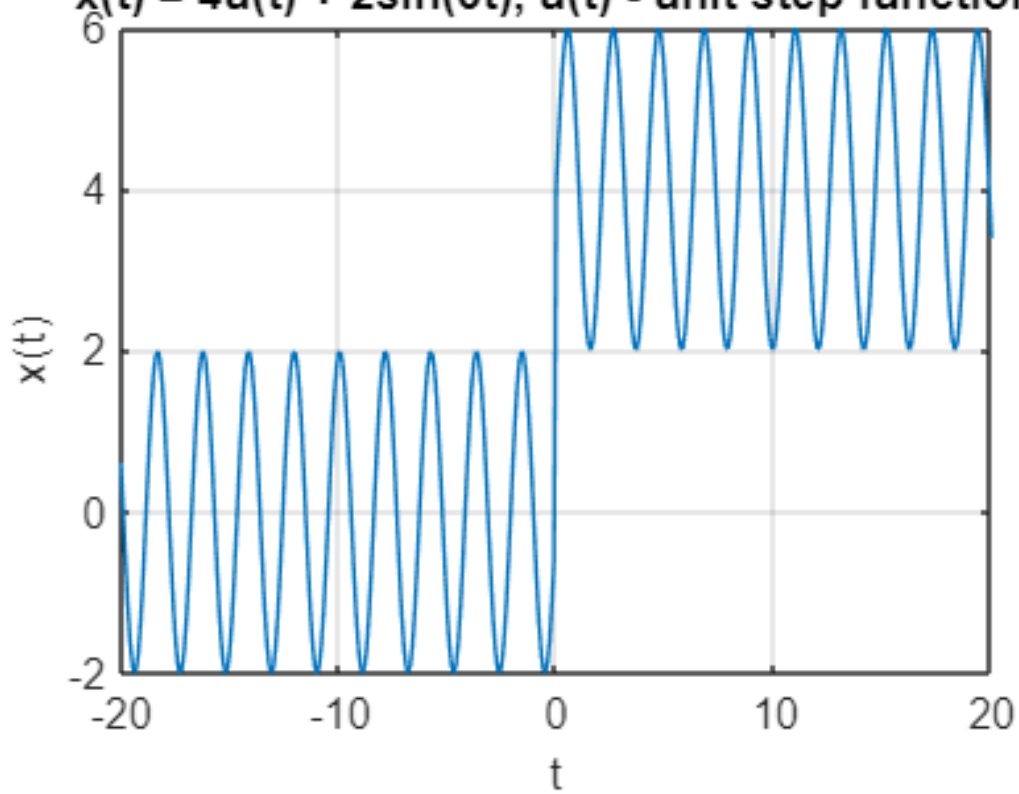


```
% Ex1
% a.
clear variables
t = -2:0.01:2;
x = @(t)(4 * cos(5 * pi * t) - pi / 4);
plot(t,x(t)); grid;
xlabel('t'); ylabel('x(t)')
title('x(t) = 4*cos(5*pi*t) - pi/4')
```

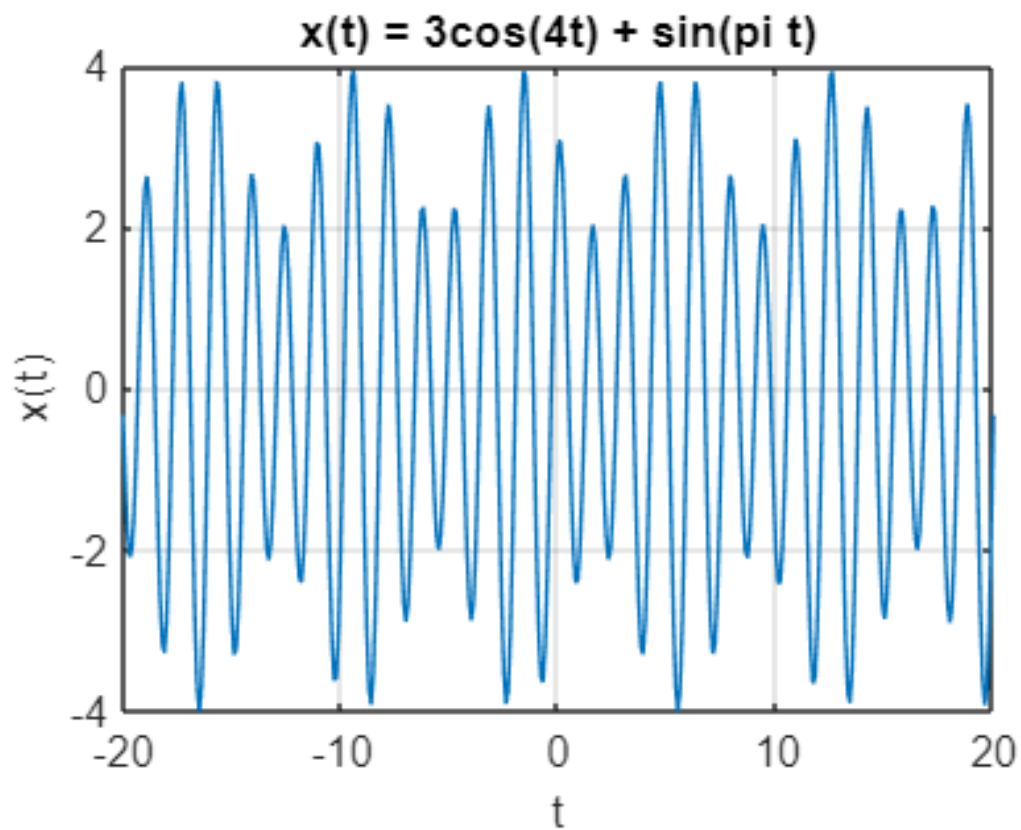


```
%b. not periodic
clear variables
u = @(t) (t >= 0);
t=-20:0.1:20;
x=@(t)(4*u(t)+2*sin(3*t));
plot(t,x(t)); grid;
xlabel('t'); ylabel('x(t)')
title('x(t) = 4u(t) + 2sin(3t), u(t) - unit step function')
```

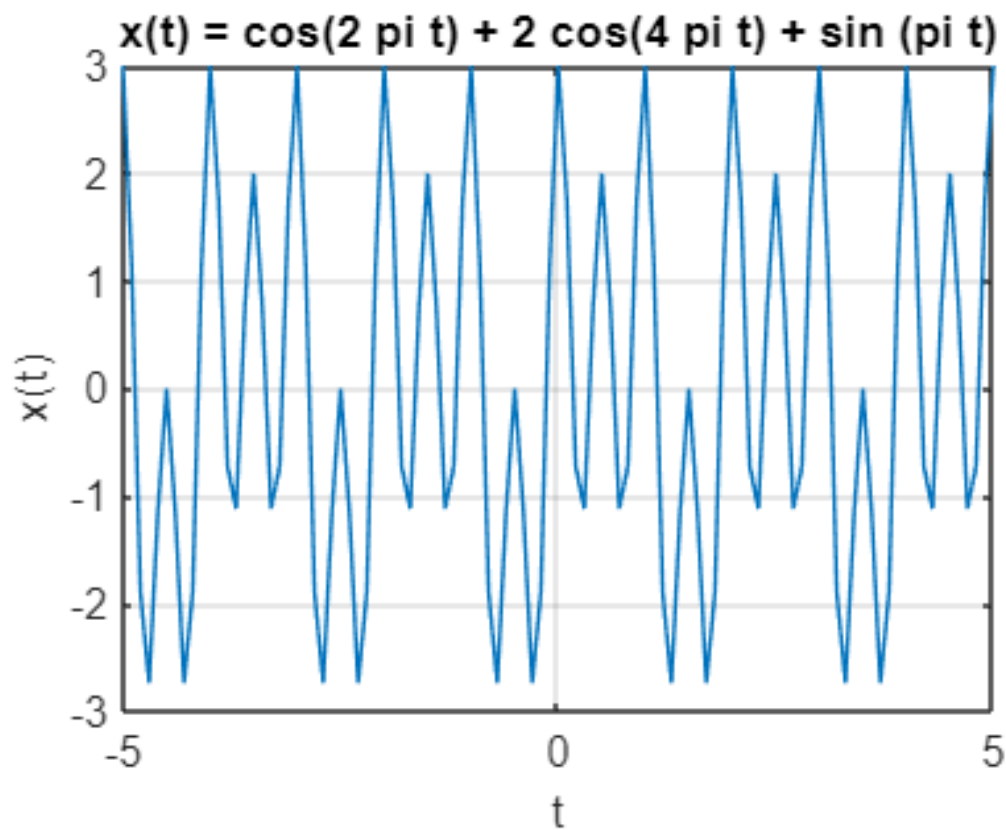
$x(t) = 4u(t) + 2\sin(3t)$, $u(t)$ - unit step function



```
%c.
clear variables
t = -20:0.1:20;
x = @(t)(3*cos(4*t) + sin(pi*t));
plot(t,x(t)); grid;
xlabel('t'); ylabel('x(t)')
title('x(t) = 3cos(4t) + sin(pi t)')
```

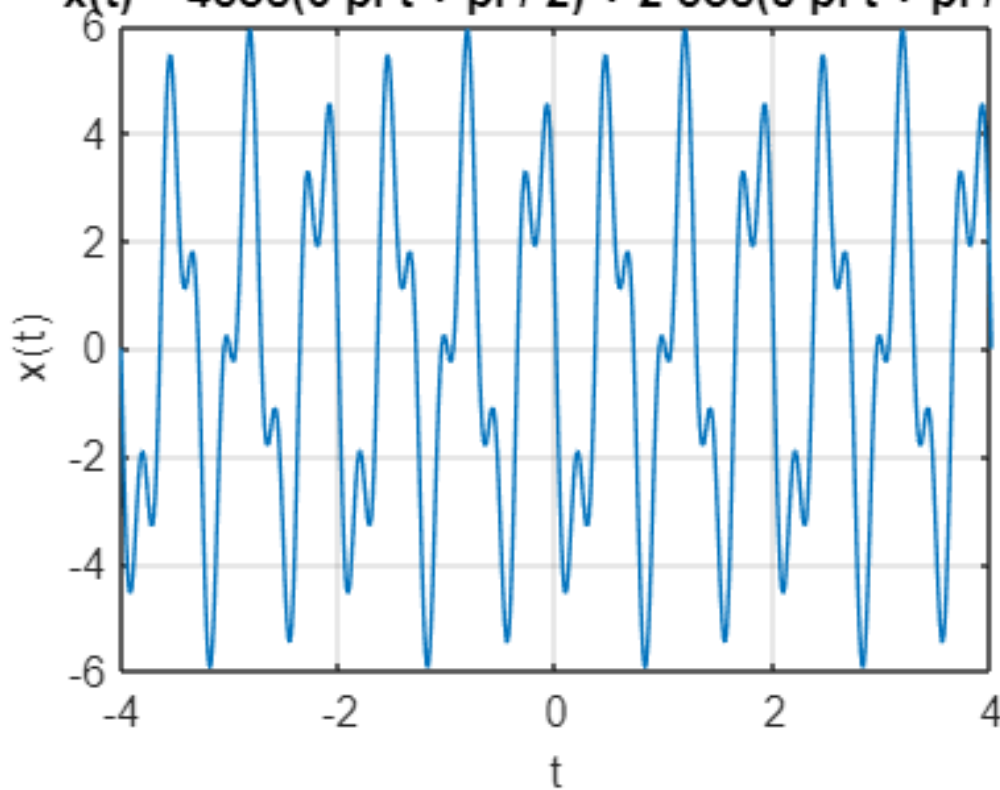


```
%d.
clear variables
t = -5:0.1:5;
x = @(t)(cos(2*pi*t) + 2*cos(4*pi*t) + sin(pi * t));
plot(t,x(t)); grid;
xlabel('t'); ylabel('x(t)')
title('x(t) = cos(2 pi t) + 2 cos(4 pi t) + sin (pi t)')
```

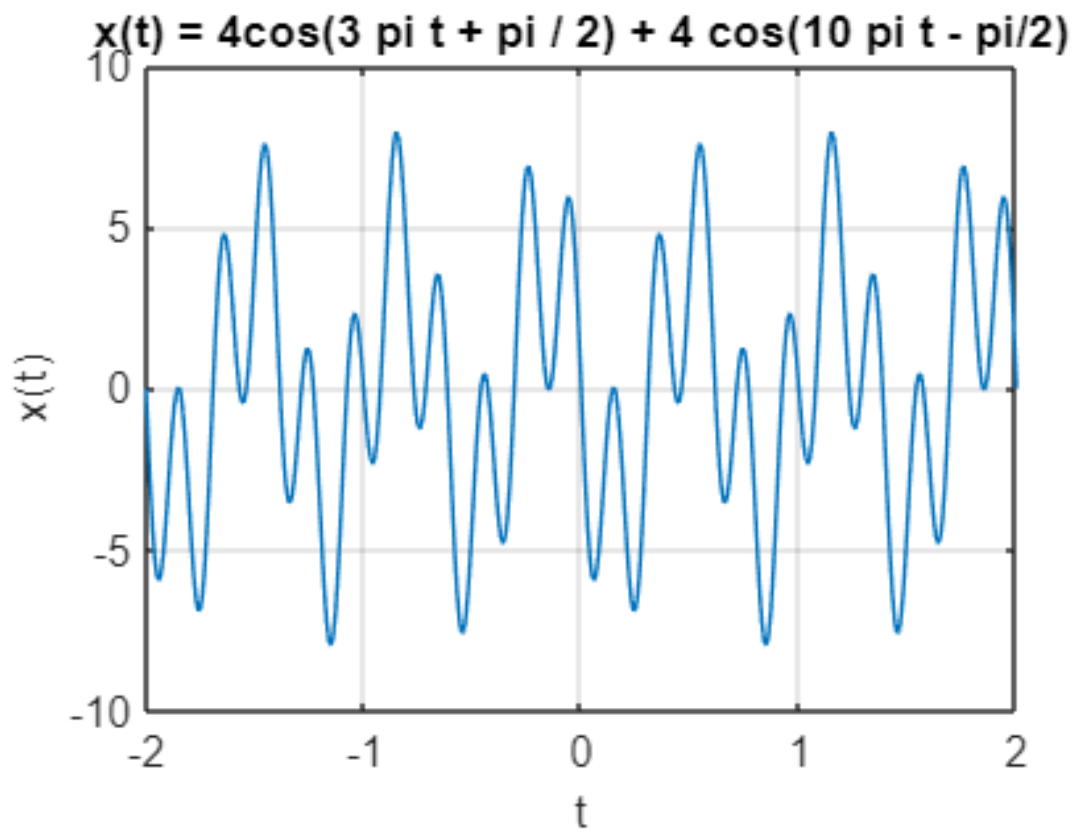


```
%e.
clear variables
t = -4:0.01:4;
x = @(t)(4*cos(3*pi*t + pi/2) + 2*cos(8*pi*t + pi/2));
plot(t,x(t)); grid;
xlabel('t'); ylabel('x(t)')
title('x(t) = 4cos(3 pi t + pi / 2) + 2 cos(8 pi t + pi / 2)')
```

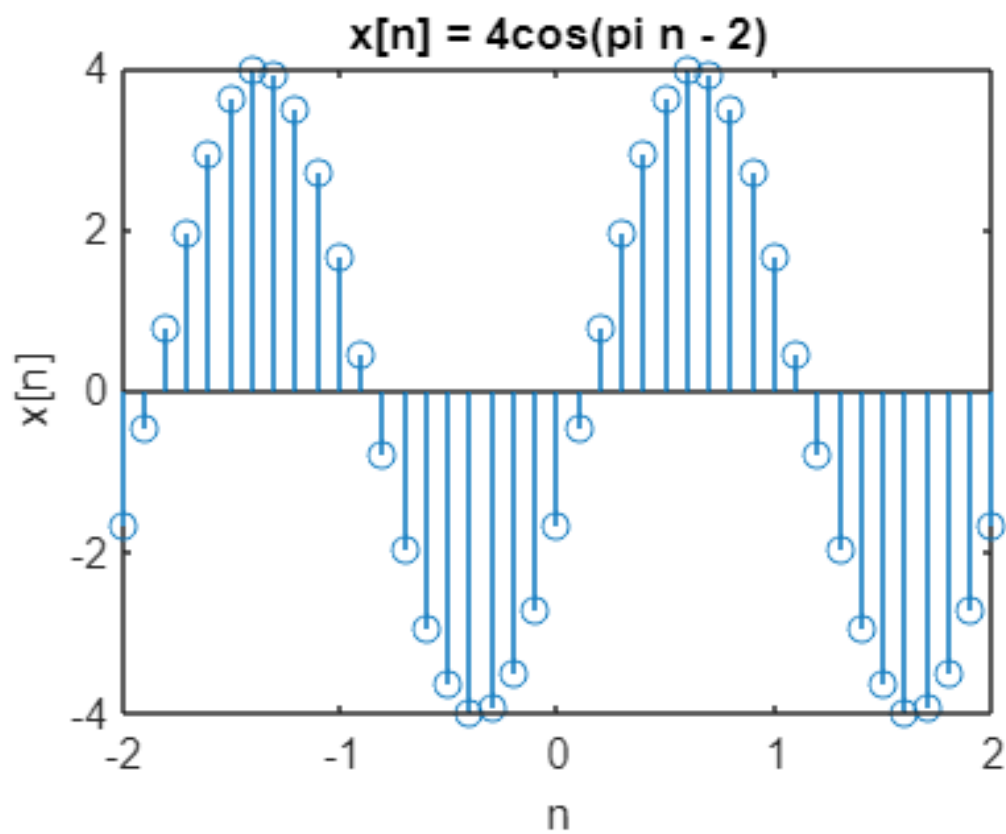

$$x(t) = 4\cos(3\pi t + \pi/2) + 2\cos(8\pi t + \pi/2)$$



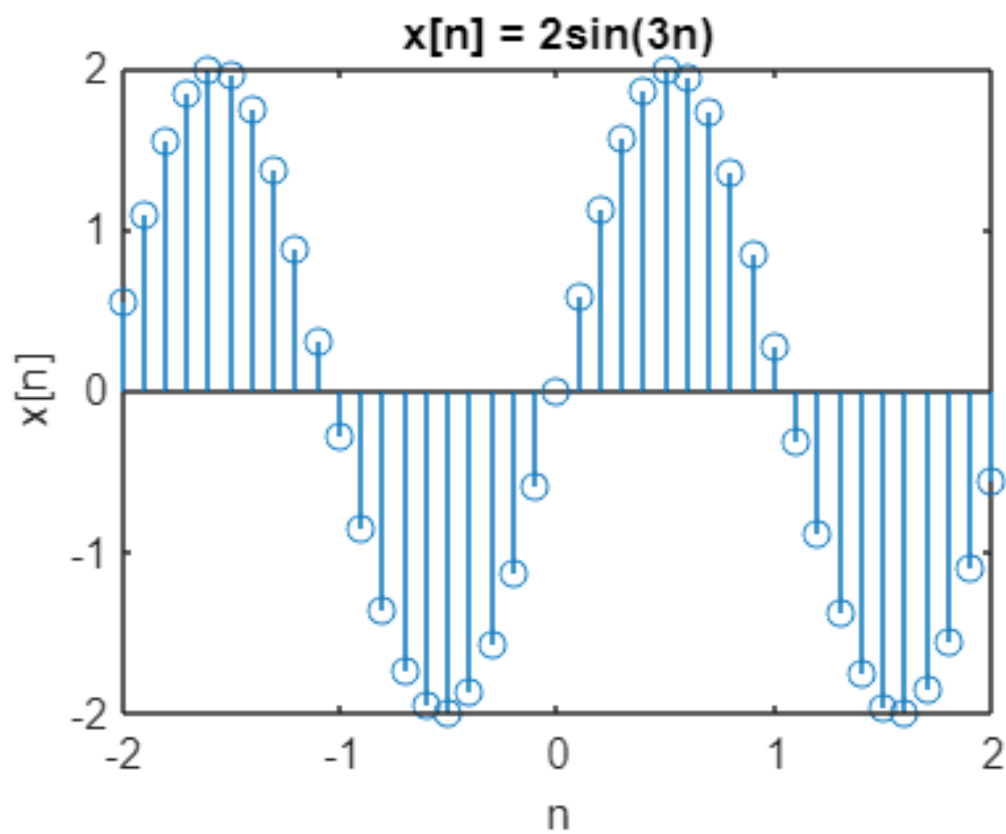
```
%f
clear variables
t = -2:0.01:2;
x = @(t)(4*cos(3*pi*t + pi/2) + 4*cos(10*pi*t + pi/2));
plot(t,x(t)); grid;
xlabel('t'); ylabel('x(t)')
title('x(t) = 4cos(3 pi t + pi / 2) + 4 cos(10 pi t - pi/2)')
```



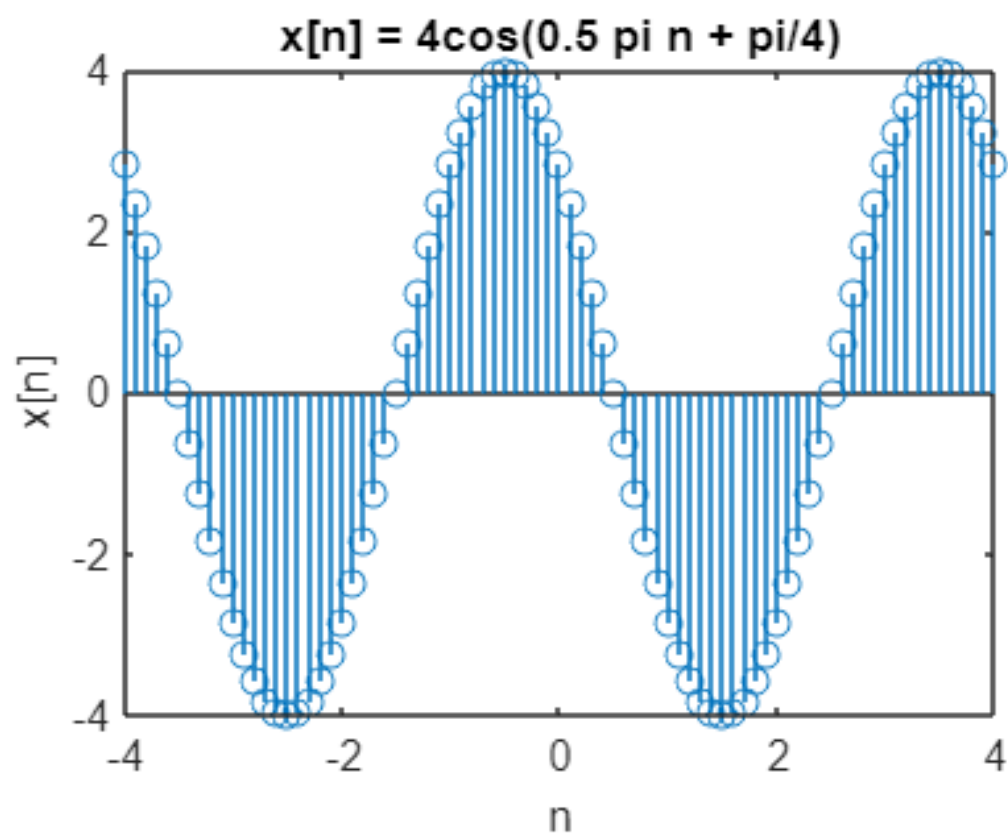
```
%g
clear variables
n = -2:0.1:2;
x = @(n)(4 * cos(pi*n - 2));
stem(n,x(n));
xlabel('n'); ylabel('x[n]')
title('x[n] = 4cos(pi n - 2)')
```



```
%h
clear variables
n = -2:0.1:2;
x = @(n)(2 * sin(3*n));
stem(n,x(n));
xlabel('n'); ylabel('x[n]')
title('x[n] = 2sin(3n)')
```



```
%i
clear variables
n = -4:0.1:4;
x = @(n)(4 * cos(0.5*pi*n + pi/4));
stem(n,x(n));
xlabel('n'); ylabel('x[n]')
title('x[n] = 4cos(0.5 pi n + pi/4)')
```



2. a) $x(t) = 4 \cos(5\pi t) - \pi/4$

$T = \frac{2\pi}{5\pi} = \frac{2}{5} \Rightarrow$ periodic function, $-\frac{\pi}{4}$ - constant

b) $x(t) = 4u(t) + 2\sin(3t)$

Because of the unit function $u(t) \Rightarrow x(t)$ is not periodic

c) $x(t) = 3 \cos(4t) + \sin(\pi t)$

$T_1 = \frac{2\pi}{4} = \frac{\pi}{2}$; $T_2 = \frac{2\pi}{\pi} = 2 \Rightarrow T = 4T_1 = \pi \cdot T_2 = 2\pi$

$\cos(4(t+2\pi)) = \cos(4t+8\pi) = \cos(4t)\cos(8\pi) - \sin(4t)\sin(8\pi) =$
 $= \cos(4t) \cdot 1 - \sin(4t) \cdot 0 = \cos(4t)$

$\sin(\pi t) \begin{cases} \rightarrow \pi \text{ is period} \\ \rightarrow k\pi \text{ is period, } k \in \mathbb{Z} \\ \rightarrow 2\pi \text{ is period} \end{cases} \Rightarrow x(t) \text{ is periodic}$

e) $x(t) = 4 \cos(3\pi t + \pi/2) + 2 \cos(8\pi t + \pi/2)$

$T_1 = \frac{2\pi}{3\pi} = \frac{2}{3}$; $T_2 = \frac{2\pi}{8\pi} = \frac{2}{8} = \frac{1}{4} \Rightarrow T = 2$

$\cos(3\pi(t+2) + \frac{\pi}{2}) = \cos(3\pi t + 6\pi + \pi/2) = \cos(3\pi t + 13\pi/2) =$
 $= \cos(3\pi t)\cos(13\pi/2) - \sin(3\pi t)\sin(13\pi/2) = \cos(3\pi t \cdot 0) - \sin(3\pi t) \cdot 1 =$
 $= -\sin(3\pi t) = \cos(3\pi t + \pi/2)$

$\cos(8\pi(t+2) + \pi/2) = \cos(8\pi t + 16\pi + \pi/2) = \cos(8\pi t + 33\pi/2) =$
 $= \cos(8\pi t)\cos(33\pi/2) - \sin(8\pi t)\sin(33\pi/2) = \cos(8\pi t) \cdot 0 - \sin(8\pi t) \cdot 1 =$
 $= -\sin(8\pi t) = \cos(8\pi t + \pi/2) \Rightarrow x(t) \text{ is periodic}$

d) $x(t) = \cos(2\pi t) + 2\cos(4\pi t) + \sin(\pi t)$

$T_1 = \frac{2\pi}{2\pi} = 1$, $T_2 = \frac{2\pi}{4\pi} = \frac{1}{2} \Rightarrow T = 2\pi$

$\cos(2\pi t) \begin{cases} \rightarrow 2\pi \text{ is period} \\ \rightarrow 2k\pi \text{ is period, } k \in \mathbb{Z} \end{cases}$

$\Rightarrow x(t) \text{ is periodic}$

$\sin(\pi t) \rightarrow \text{periodic}$

$$f) x(t) = 4 \cos(3\pi t + \pi/2) + 4 \cos(10\pi t + \pi/2)$$

$$T_1 = \frac{2\pi}{3\pi} = \frac{2}{3} ; T_2 = \frac{2\pi}{10\pi} = \frac{1}{5} \Rightarrow T = 2$$

$$\begin{aligned} \cos(3\pi(t+2) + \pi/2) &= \cos(3\pi t + 6\pi + \pi/2) = \cos(3\pi t) \cos(13\pi/2) - \\ &- \sin(3\pi t) \sin(13\pi/2) = \cos(3\pi t) \cdot 0 - \sin(3\pi t) \cdot 1 = \sin(3\pi t) = \cos(3\pi t + \pi/2) \\ \cos(10\pi(t+2) + \pi/2) &= \cos(10\pi t + 40\pi/2) = \cos(10\pi t) \cos\left(\frac{41\pi}{2}\right) - \sin(10\pi t) \cdot \\ &\cdot \sin(41\pi/2) = \cos(10\pi t + \pi/2) \Rightarrow x(t) \text{ is periodic} \end{aligned}$$

$$g) x[n] = 4 \cos(\pi n - 2)$$

$$\Omega = \pi, N = \frac{2\pi}{\pi} = 2$$

$$\Omega = \frac{2\pi m}{N} \Rightarrow \pi = \frac{2\pi m}{N} \Rightarrow m = 1$$

$x[n]$ is periodic

$$h) x[n] = 2 \sin(3n)$$

$$3 = \frac{2\pi m}{N} \Rightarrow N = 2\pi ; m = 3$$

$$i) x[n] = 4 \cos(0.5\pi n + \pi/4)$$

$$\frac{\pi}{2} = \frac{2\pi m}{N} \Rightarrow N = 4, m = 1$$